

REMARKS

Claims 1-7, 9-15, 17-22, 24-30, 32-38, 40-46, 48-54 and 56-58 are pending in the application.

Claims 1-7, 9-15, 17-22, 24-30, 32-38, 40-46, 48-54 and 56-58 stand rejected.

Claims 18 and 58 have been amended.

Objections to the Drawings

The drawings are objected to for failing to show every feature of the invention specified in the claims. Specifically, the Examiner contends that following claim features are not shown in the drawings: “creating a plurality of multi-feature packet processing rules, ...”, “populating said plurality of multi-feature packet processing rules ...”, “populating an associated content-addressable memory ...” and similar language in claims 1, 9, 17, 24, 32, 40 and 48. Applicant respectfully traverses this objection.

Applicant respectfully submits that the drawings of the present invention include examples of the features cited in Section 6 of the Office Action. Regarding the “multi-feature packet processing rules” recited in claims 1, 17, 24 and 40, Applicant respectfully submits that this feature is adequately enabled by the teachings of the application as filed in that one reasonably skilled in the art could make or use the invention from the disclosures in the application coupled with information known in the art without undue experimentation. See MPEP § 2164.01 *Test of Enablement*. Applicant respectfully cites Fig. 1 (content addressable memory 140); the Specification at p. 7, line 27, through p.8, line 4; and originally filed claims 1-

2, 4-5, 8-10, 12-13, 16, 23-25, 27-28, 31-33, 35-36, 39-41, 43-44, 47-49, 51-52 and 55, as examples of support for this limitation.

Regarding the “creating a plurality of multi-feature packet processing rules” and similar limitations recited in claims 1, 9, 24, 40 and 48, Applicant respectfully submits that this feature is adequately enabled by the teachings of the application as filed in that one reasonably skilled in the art could make or use the invention from the disclosures in the application coupled with information known in the art without undue experimentation. See MPEP § 2164.01 *Test of Enablement*. Applicant respectfully cites the Specification at p. 4, line 16, through p.7, line 10; and Tables 1 and 2, as examples of support for this limitation.

Regarding the “populating said plurality of multi-feature packet processing rules” and similar limitations recited in claims 1, 24 and 40, Applicant respectfully submits that this feature is adequately enabled by the teachings of the application as filed in that one reasonably skilled in the art could make or use the invention from the disclosures in the application coupled with information known in the art without undue experimentation. See MPEP § 2164.01 *Test of Enablement*. Applicant respectfully cites the Specification at p. 4, line 16, through p.7, line 10; Tables 1 and 2; and originally filed claims 1, 8, 16, 23-24, 31, 39-40, 47 and 55, as examples of support for this limitation.

Regarding the “associated content-addressable memory” recited in claims 1, 24 and 40, Applicant respectfully submits that this feature is adequately enabled by the teachings of the application as filed in that one reasonably skilled in the art could make or use the invention from the disclosures in the application coupled with information known in the art without undue experimentation. See MPEP § 2164.01 *Test of Enablement*. Applicant respectfully cites Fig. 1 (multi-feature classification memory 150); Fig. 2; the Specification at p. 4, ll.2-15, and p.7, ll.

12-26; and originally filed claims 1, 4, 24, 27, 40 and 43, as examples of support for this limitation.

Applicant notes that the scope of the invention is defined by the claims and not by specific examples found in the specification and drawings.

Because claims 1, 9, 17, 24, 32, 40 and 48 are adequately enabled by the application as filed, Applicant respectfully submits that the drawings of the Application meet the requirements of 35 U.S.C. § 113. See MPEP § 608.02. The application includes at least one drawing and therefore meets the requirements of the first sentence of 35 U.S.C. § 113. Consequently, any rejections of the drawings being inadequate should fall under the second sentence of 35 U.S.C. § 113. Applicant respectfully notes MPEP § 608.02(a), subsection entitled *Handling of Drawing Requirements under the Second Sentence of 35 U.S.C. § 113*. This subsection states that further illustrations required by the Examiner “should be done prior to examination in a separate letter.”

Rejection of Claims under 35 U.S.C. §112

Claims 18-22 and 58 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant has amended claims 18 and 58 to address the Examiner’s concerns, and respectfully submit this rejection is overcome thereby.

Rejection of Claims under 35 U.S.C. §103

Claims 1-7, 9-15, 17-22, 24-30, 32-38, 40-46, 48-54 and 56-58 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Uga et al., U.S. Patent No. 6,718,326 (“Uga”), in view of Venkatachary et al., U.S. Patent Publication No. 2002/0089937 A1 (“Venkatachary”).

While not conceding that the cited references qualify as prior art, but instead to expedite prosecution, Applicant has chosen to respectfully disagree and traverse the rejection as follows. Applicant reserves the right, for example, in a continuing application, to establish that the cited references, or other references cited now or hereafter, do not qualify as prior art as to an invention embodiment previously, currently, or subsequently claimed.

In order for a claim to be rendered invalid under 35 U.S.C. § 103, the subject matter of the claim as a whole would have to be obvious to a person of ordinary skill in the art at the time the invention was made. *See* 35 U.S.C. § 103(a). This requires: (1) the reference(s) must teach or suggest all of the claim limitations; (2) there must be some teaching, suggestion or motivation to combine references either in the references themselves or in the knowledge of the art; and (3) there must be a reasonable expectation of success. *See* MPEP 2143; MPEP 2143.03; *In re Rouffet*, 149 F.3d 1350, 1355-56 (Fed. Cir. 1998).

At the outset, while maintaining points made in earlier Office Action responses, Applicant respectfully notes the fundamental structure of the invention, as claimed in independent claims 1, 9, 17, 24, 32, 40 and 48, is generally directed to methods, systems network elements and so on, that employ a content-addressable memory that, when presented with information from a packet, in turn presents an index to a multi-feature classification memory, in which each of the multi-feature packet processing rules is formed by merging a plurality of features from a feature hierarchy. Thus, each rule actually represents a number of rules that have been merged into the one rule.

Each of these memories stores respective information regarding the processing of a packet (an index into the multi-feature classification memory, in the case of the content-addressable memory, and one or more multi-feature packet processing rules stored in the multi-

feature classification memory). The use of multi-feature packet processing rules differs markedly from anything taught in Uga or Venkatachary, or otherwise known in the art at the time of invention.

Thus, according to the claimed invention (as claimed in independent claims 1, 9, 17, 24, 32, 40 and 48), providing the first memory (e.g., the content-addressable memory) with information from a packet allows the first memory (e.g., the content-addressable memory) to provide an index that is then used to access one or more corresponding multi-feature packet processing rules stored in the second memory (e.g., the multi-feature classification memory). In so doing, the network device employing the claimed invention can then use appropriate ones of its features to perform appropriate processing on the packet. Advantageously, the claimed multi-feature classification memory is configured to store multi-feature packet processing rules, which are formed by merging a plurality of features into a single multi-feature packet processing rule. Thus, by merging features into multi-feature packet processing rules, the “multi-feature CM eliminates the need for individual associated CMs.” (Specification, p. 4, ll. 13-14) As also noted in the Specification:

“Various features implemented in a router can be organized into a feature hierarchy. The feature hierarchy can be based on various user application related factors (i.e., e.g., per entry implementation cost, functionality, subsumability of the feature or the like). According to one embodiment of the present invention, features that require complex packet-processing rules (e.g., full functionality features such as statistics, policing, redirection or the like) and can subsume simple features (e.g., ACL or the like) are considered at the top of the feature

hierarchy. Other forms of feature hierarchy are possible.” (Specification, p. 4, ll. 18-25)

Thus, the claimed multi-feature packet processing rules provide for a more flexible, efficient manner of packet processing. This distinction is borne out by comparing the claimed invention with the systems disclosed in Uga and Venkatachary. Claim 1 recites:

1. A method of processing a packet comprising:
creating a plurality of multi-feature packet processing rules, wherein
said creating comprises, for each multi-feature packet processing rule of said
multi-feature packet processing rules,
forming said each multi-feature packet processing rule by merging a
plurality of features from a feature hierarchy,
each of said features is defined in said feature hierarchy, and
at least one of said features in said feature hierarchy comprise another of said
features in said feature hierarchy, and
populating said plurality of multi-feature packet processing rules in a multi-feature
classification memory; and
populating an associated content-addressable memory with a plurality of indices, wherein
said indices are indices of said plurality of multi-feature packet processing rules in
said multi-feature classification memory,
said content-addressable memory and said multi-feature classification memory are
associated with one another by virtue of said content-addressable memory
being coupled to provide an index of said indices to said multi-feature
classification memory, and
each of said indices corresponds to at least one of said multi-feature packet
processing rules.

Applicant respectfully notes that independent claims 9, 17, 24, 32, 40 and 48 recite, among other limitations, limitations substantially similar to those presented above.

By contrast, Uga is directed to:

“A packet classification search device and method ... which are capable of searching rules of packet classification having very long search bit width at high speed while using a CAM which has a limited bit width. The fields of rules of packet classification are grouped into groups, and the grouped fields of each rule are stored along with search related information (except for the initial group) and number of searches information in a CAM. The next number of searches information (if further groups exist which must be searched), comparison related information, and actions related to packets (if further groups exist which must be searched, directing searching again, while if no further groups exist which must be searched, actions for packet classification) are stored in a search result storage device. By doing this it is made possible to search with the bit width of the group unit.” (Uga; Abstract)

By further contrast, Venkatachary is directed to:

“... a Packet Matching System and Method. A Matching Rules Database is quickly searched for a Best Matching Rule for a packet header. Power is

conserved in the system by searching only a small subset of rules of the rules database. An All Matching Rules Engine comprising a plurality of Necessary Path Condition Rules is searched to determine which subset of matching rules, or sub-databases, to search for a best matching rule. The sub-databases are then searched by Best Matching Rules sub-Engines and a best matching rule is selected from the results of the sub-database searches by a Collate Engine. The Rules Database is organized according to a Hierarchical Subdivision Tree. Necessary Path Condition Rules and sub-databases are extracted from the Hierarchical Subdivision Tree.” (Venkatachary; Abstract)

As an initial matter, Applicant respectfully submits that, among other infirmities, the Office Action correctly notes that Uga fails to show, teach or suggest:

“...

creating a plurality of multi-feature packet processing rules, wherein
said creating comprises, for each multi-feature packet processing rule of said
multi-feature packet processing rules,
forming said each multi-feature packet processing rule by merging a
plurality of features from a feature hierarchy,
each of said features is defined in said feature hierarchy, and
at least one of said features in said feature hierarchy comprise another of said
features in said feature hierarchy, ...”

The Office Action turns to Venkatachary to cure this infirmity. Unfortunately, the approach taken in Venkatachary is counter to that of the claimed invention, and so fails to

address the noted shortcoming of Uga. The “rule merging technique” noted in the Office Action is, per the Office Action, discussed at para. 43 of Venkatachary:

“The number of NPCR entries in the All Matching Rules Engine can be reduced, along with the number of sub-rule databases, via a rule merging technique called Rule Subset Hoisting. Through Rule Subset Hoisting, subsets of rules comprising a sub-database having less than a number T_{min} of rules are merged to create a new sub-database having greater than T_{min} rules but less than T rules.” (Venkatachary, para. 43)

This passage merely describes a technique for increasing the number of rules in a sub-database. While this approach may result in fewer NPCR entries, it does so at the cost of increasing the complexity of the given sub-database. For example”

“These rules are “hoisted” up to their parents. For example, sub-rule set 300 is hoisted to it's parent 316. Sub-rule sets 304 and 306 are hoisted up to their parent 312, producing a new sub-rule set of $3+3=6$ rules in node 312. Sub-rule sets 302 and 308 are **hoisted up to parent 314 to form a subset of $5+2=7$ rules**, and sub-rule set 310 is hoisted up to node 318.” (Venkatachary, para. 47; Emphasis supplied)

This provides a segue into a discussion of a major flaw of Venkatachary in its supposed teaching of various limitations of the claimed invention. The sub-databases of Venkatachary are created to reduce the number of rules that must be analyzed to determine the manner in which a packet needs to be processed. (Venkatachary, paras. 6 and 7) By choosing an appropriate sub-engine (which analyzes a sub-database), fewer than all rules are analyzed. But the approach used in Venkatachary still analyzes each rule, if it is to be analyzed, separately. There is no provision, or even recognition, that such rules can be merged with one another.

The only “merging” that occurs in Venkatachary is the combining of sub-databases, as noted above, and in para. 14 of Venkatachary:

“The Packet Matching System 10 comprises an All Matching Rules Engine (AMRE) 100, a plurality of Best Matching Rules sub-Engines (BMRSE) 102, and a Collate Engine 104. The AMRE 100 takes as input a packet header and compares the packet header to a set of Necessary Path Condition Rules (NPCR). Necessary Path Condition Rules will be discussed in detail below. The result of the comparison defines a subset of classification rules to be searched in order to find a best matching rule. **Subsets of matching rules are grouped together as sub-databases.** Sub-databases will be discussed in detail below.” (Venkatachary, para. 14; Emphasis supplied)

Thus, while groups of Venkatachary's rules may grow or shrink, the rules in each sub-database are separate rules, and remain so. By contrast, the claimed invention employs multi-feature packet processing rules, which are formed by merging a plurality of features into one rule.

Applicant therefore respectfully submits that the Office Action does not establish the presence of these limitations in Uga or Venkatachary, taken alone or in any permissible combination. As will be appreciated, the Office Action bears the burden of supporting a case of obviousness, including whether the prior art references teach or suggest all of the claim limitations. *See* MPEP 706.02(j).

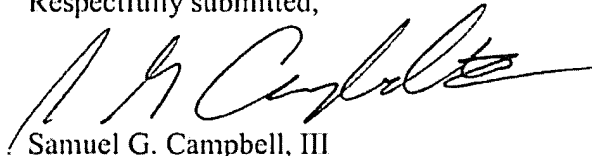
For at least the foregoing reasons, Applicant respectfully submits that claims 1, 9, 17, 24, 32, 40 and 48, and all claims dependent thereon, are in condition for allowance. Applicant therefore requests the Examiner's reconsideration of the rejection of those claims.

CONCLUSION

In view of the amendments and remarks set forth herein, the application is believed to be in condition for allowance and a notice to that effect is solicited. Nonetheless, should any issues remain that might be subject to resolution through a telephonic interview, the Examiner is invited to telephone the undersigned at 512-439-5084.

If any extensions of time under 37 C.F.R. § 1.136(a) are required in order for this submission to be considered timely, Applicant hereby petitions for such extensions. Applicant also hereby authorizes that any fees due for such extensions or any other fee associated with this submission, as specified in 37 C.F.R. § 1.16 or § 1.17, be charged to deposit account 502306.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'S. G. Campbell, III', with a stylized flourish at the end.

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